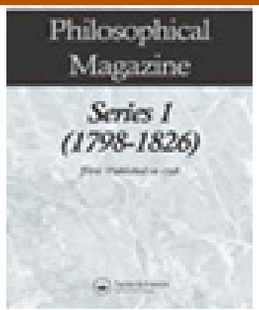

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XXIX. Memoir on the anatomy of vegetables. Read before the Physical Class of the Institute

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But in a recent publication, the following table is given as the refult of a more extenfive collection of inftances of longevity.

Of males and females who lived from 100 to 110 years, both inclufive, the inftances have been	-	1310
Above 110 to 120	-	277
120 to 130	-	84
130 to 140	-	26
140 to 150	-	7
150 to 160	-	3
160 to 170	-	2
170 to 185	-	3
		1712*

Conclufion.

Such is the fubftance of the obfervations which have occurred to me on this intereffing fubject. I fhall conclude with remarking, that on the whole it is more than probable, by proper attention and good management, perfons in general might not only live longer, but might enjoy life with more reliffh, than is commonly the cafe at prefent; and it is to be hoped, in refpect of this, as well as of many other particulars, that human nature is ftill in the threfhold of acquirement, that it will yet obtain greater and more important acquifitions of knowledge, and may reach further improvement both with regard to the extent of perfonal and mental gratifications, which our fpecies may be found capable of enjoying, and alfo the means of poffeffing them, with more fatisfaction and comfort, and for a much longer period of time.

[To be continued.]

XXIX. *Memoir on the Anatomy of Vegetables. Read before the Phyfical Claffs of the Inftitute by* C. MIRBEL.

[Continued from p. 40]

CHAP. IV.

Of the tubular Tiffue.

THERE are two kinds of tubes, the great and the fmall.

Art. I. *Of the large tubes.*—The large tubes during the firft period of their formation are not, as might be fuppofed, membranaceous canals feparate and diftinct from the tiffue;

* See Eafton on Longevity, printed an. 1799.

and

and they exiſt only becauſe there is a lacuna in the membranes. Such is the extreme ſimplicity of the organization of vegetables, that all the difference obſerved in them is merely confined to ſome modifications in the cellular tiſſue. But the ſides of theſe large tubes, being continually moiſtened by the fluids imbibed by the plant, gradually aſſume more conſiſtence, and ſeparate from the reſt of the tiſſue when their ſolidity ſurpaſſes that of the ſurrounding membranes. I could never obſerve large tubes in muſhrooms, lichens, and fuci, even when I employed a microſcope; but it is ſufficient to have good ſight to be able to diſtinguiſh the aperture of theſe canals on the tranſverſal ſection of the ſtems, the branches, and roots, of ſeveral monocotyledons and dicotyledons. In the former, they are always found in the centre of the ligneous filaments, and ſometimes they compoſe the major part; in the ſecond they are diſtributed often, as it were, at random in the wood; ſometimes alſo they form groups placed very regularly at certain diſtances, or they are ranged in concentric zones. They are exceedingly numerous, in particular around the medullary canal. They are found alſo in the bark. If their progreſs be followed they will be ſeen to have their origin in the root, to enter the trunk, and to riſe parallel to each other: then to unite, to ſeparate and deviate from their vertical direction, to penetrate the bud which is formed at the ſurface of the bark; to lengthen with it, and to diſtribute themſelves throughout all its ramifications, to paſs from the branch into the ligneous filaments the bundle of which compoſes the petiole, and to divide themſelves among the large fibres of the leaves as the arteries and veins diſtribute themſelves in the human body. They may be obſerved alſo in the fibres of the perianthes, the filaments of ſome ſtamina, the piſtils, and the ligneous filaments which traverſe the pulp of fruits. Scarcely is the embryo formed when theſe tubes are obſerved. In this infancy of the vegetable they are not concealed by the wood, which does not yet exiſt: the ſubſtance deſtined to produce it is then in a ſtate of fluidity, which permits the obſerver to examine the parts which it covers. It is not yet the proper place for ſpeaking of the vegetable chyle produced by the fluids aſſimilated in the veſſels of the plant, I ſhall recur to that ſubject hereafter. The large tubes form ſometimes medullary radii, as I have obſerved in the equiſetum or horſe-tail; but, in my opinion, this caſe is rare.

The large tubes are of four kinds: ſimple tubes, porous tubes, falſe tracheæ, and tracheæ. Theſe are modifications of the ſame organ.

1ſt, *Simple tubes.*—The ſides of theſe tubes are perfectly whole, neither pores nor fiſſures are obſerved in them: they generally contain reſinous or oily juices, known under the denomination of *proper juices*. Theſe tubes are very remarkable in green trees, in euphorbia, periploca, and, in general, in all plants the juices of which are thick. They are more numerous and more viſible in the bark than in any other part.

2d, *Porous tubes.*—The ſides of theſe tubes are perforated with ſmall pores ſimilar to thoſe mentioned in the article on the cellular tiſſue, with this difference, that they are much more numerous, and that, inſtead of being diſſeminated by chance, and without order, as is often the caſe, in the cells, they are diſtributed in regular and parallel ſeries around the tubes. Theſe tubes do not appear to be ſo peculiarly deſtined as the preceding to contain reſinous or oily juices. They are very numerous in hard wood, ſuch as the oak.

3d, *The falſe tracheæ.*—Theſe tubes are interſected in a tranſverſal direction with parallel ſlits, which from their appearance might induce us to believe that they are formed of rings placed one above the other, or of filaments twiſted in a ſpiral form; but they cannot be unrolled, or ſeparated into diſtinct rings; and beſides, with a little attention, one may diſcover the continuity of the membrane, and conſequently the place where the ſlits end. Theſe, then, are porous tubes, but their pores are much larger than thoſe of the preceding. I muſt even obſerve, that the edge of the ſlits is furniſhed with a roll ſimilar to that which ſurrounds the ſmall pores. Theſe tubes are deſtined for the ſame purpoſes as the porous tubes; but in general they are found in thoſe kinds of wood which are leſs hard and compact, and even in herbaceous plants: I have obſerved them in a great number of the monocotyledons. The centre of the lycopodia preſents a thick cylinder compoſed, in a great meaſure, of veſſels of this nature. Ferns contain alſo a great many in their ligneous filaments. Dicotyledons are likewiſe provided with them. They are exceedingly numerous in the vine, the wood of which is ſoft and porous.

4th, *The tracheæ.*—Want of experience has aſſigned to theſe tubes, which have not been ſufficiently obſerved, a denomination conſecrated by cuſtom. The tracheæ of plants have a reſemblance in their form to the tracheæ of inſects, and it has thence been concluded, on too ſlight grounds, that theſe tracheæ in the former as well as in the latter muſt be the organs of reſpiration. The vegetable trachea is a tube formed of a filament twiſted into a ſpiral form from right to left.

left. This filament is opake, brilliant, argenteous, and thick. Its tranſverſal ſection preſented to me ſometimes a flat plate or an ellipſis, and ſometimes even two filaments united by an intermediate membrane; but I never could obſerve the aperture of a tube, as ſeveral authors have aſſerted. The ſurface is ſometimes ſmooth, ſometimes unequal, and ſometimes porous. The ſpirals of the tracheæ are often ſo cloſe, that when their arrangement is not diſturbed, on breaking or cutting, without precaution, the parts which conceal them, they appear to be continued tubes ſlightly ſtriated. Malphigi and Reichel ſay that choked parts have been remarked in the length of the tracheæ; and at firſt I believed that I obſerved the ſame, but I have ſince found that this was merely an optical illuſion. Theſe tubes exiſt in great numbers in the herbaceous monocotyledons and dicotyledons, but eſpecially in the aquatic kinds, the tiſſue of which is weaker: they occupy the centre of the ligneous filaments in the monocotyledons; in trees with two cotyledons they are ſeen around the pith: in theſe they are often mixed, and confounded with the falſe tracheæ. I never ſaw them in the hard parts of vegetables, unleſs theſe parts had long been in a ſtate of ſoftneſs, which permitted the tracheæ to expand: this is what takes place in branches and twigs from which the pith has diſappeared. Theſe tubes have formed themſelves when the medullary ſubſtance exiſted. The tracheæ are not found in the length of the bark; they penetrate into the petioles and leaves in the ſame manner as the falſe tracheæ; they every where act the ſame part as the latter, and do not contain thick juices but in plants where they are very abundant, ſome as of the lily kind. It is well known that, to ſee theſe organs with the naked eye, it is neceſſary to take a young, green, and ſoft branch, to twiſt and break it without violence, that the tracheæ may be unrolled without rupture: if the two parts of the branch which have been divided be then oppoſed to the light, one can diſtinguiſh the half-unrolled filaments which proceed from the one part to the other, and the ſpirals are cloſe or at a diſtance, according as the parts are brought near to, or removed from, each other. They unroll themſelves or contract in the ſame manner in leaves which have been torn. The leaves, however, of the *butomus umbellatus* exhibit a contrary phænomenon; the tracheæ, which in this plant are exceedingly numerous, when once unrolled no longer contract themſelves.

Let us now return to the large tubes in general. The diviſion into ſimple tubes, porous tubes, falſe tracheæ, and tracheæ,

tracheæ, is not rigorous. In eſtabliſhing it, I do not pretend to aſſign immutable laws of nature; I have had occaſion to obſerve that it often deviates from them. Thus the *butomus umbellatus* exhibits in the ſame tube the pores of the porous tubes, the ſlits of the falſe tracheæ, and the ſpirals of the true tracheæ; ſo that one tube comprehends three of the modifications I have deſcribed. Theſe tubes I call the mixt. Other vegetables exhibit ſomething analogous or in ſimilar ſituations, there are found in them one of the four varieties of the large tubes. It is not uncommon to ſee all theſe tubes cloſely united the one to the other, and forming only one tiſſue. In a word, it may be conjectured, with ſome appearance of reaſon, that in many caſes the tracheæ unroll themſelves only becauſe the membranes which unite their ſpirals are torn. Let us conclude then that theſe differences, which on the firſt view appear of ſo much importance, are only ſlight ſhades in the vegetable economy. But the large tubes, conſidered in a more general manner, preſent themſelves to the mind as the creative organs; their numerous ramifications diſtributed throughout all the parts of the vegetable carry thither the vivifying juices; by theſe the ſtem acquires more vigour, the bud is produced, pierces the bark, and lengthens under the form of a branch; the leaf expands, the flower blows, and the fruit ſwells up and ripens, while the embryo concealed in its boſom receives its firſt nutritive juices.

Article II.

Of the ſmall Tubes.

Theſe are compoſed of cells united to each other like thoſe which compoſe the cellular tiſſue; but in the cellular tiſſue the diameter of the cells is nearly equal in every direction; while in the former the cells are much elongated, and form real tubes, the extremities of which are ſhut: the ſides alſo are leſs tranſparent, and the membranes of which they are formed have more conſiſtence: they are often perforated with a great number of pores. This tiſſue is thick, ſolid, and tenacious. It is generally difficult to cut it through; but it preſents much leſs reſiſtance lengthwiſe, and often ſeparates eaſily into threads of greater or leſs delicacy, and which very improperly have been called fibres. The ſolidity of the vegetable depends in particular on the quantity and denſity of this tiſſue: it contains, according to the ſpecies in which it is found, ſometimes thick and coloured juices, but ſometimes, and more commonly, limpid and colourleſs juices. In the

fir

fir it is impregnated with a reſinous liquor; in the vine, eſpecially at the time of the ſap, it abounds with an aqueous fluid.

The embryo, ſtill incloſed in its teguments, has few or no ſmall tubes: all its parts are ſoft or almoſt mucilaginous. This tiſſue is never found but in the expanded plant. It is obſerved in the centre or at the circumference of the ramifications of certain ramified lichens, and in the ſtems of moſs: in monocotyledons, this tiſſue diſtributed around the large tubes forms the ligneous filaments; in dicotyledons, placed around the pith, and the large ſurrounding tubes, it forms the ligneous ſtrata. The ſmall and large tubes are generally united: the exiſtence of the former depends on the preſence of the latter. The bond which connects them is nothing elſe than that which unites the effect to the cauſe. Large tubes, however, are ſometimes found without the ſmall, and the ſmall without the large; but it is to be recollected that the latter are the creative organ, and conſequently their exiſtence is independent of that of the others. So much for the firſt caſe. And it muſt be conſidered that there is an epoch for many vegetables at which the large tubes are filled up with the tiſſue to which they gave birth. So much for the ſecond caſe.

The prominent parts of the grooves and ſtriæ which cover the ſurface of the vegetables are bundles of ſmall tubes. This tiſſue is obſerved alſo in the moſt delicate ribs of the leaves and petals: it penetrates the ſtamina and piſtils, and reaches to the extremity of the ſtigmata; but in theſe delicate organs it loſes its rigidity, and is nothing but cellular tiſſue very much elongated.

Chap. V.

Of Lacunæ.

Nature, which effects expanſion without violence, and which conducts organized beings, by inſenſible gradations, from non-exiſtence to life, and from life to death, ſeems here to deviate from her uſual progreſs: ſhe deſtroys to create, and from the annihilation of organs gives birth to a new organic ſyſtem. Lacunæ are regular and ſymmetric vacuities formed in the interior of vegetables by the laceration of their membranes.

Lacunæ, in general, exiſt only in plants, the tiſſue of which is ſoft. They are very numerous in moſt of the aquatic herbs. They are, however, found ſometimes in vigorous trees the wood of which is very hard; but in all caſes they are formed only by the deſtruction of the cellular tiſſue, which is the weakeſt

weakeſt part of the membranous tiſſue. If lacunæ occur more frequently in the monocotyledons, it is becauſe theſe vegetables in general have leſs vigour, and an organization leſs perfect; or, if I may venture to ſay, leſs vegetative power. A phænomenon which deſerves the attention of phyſiologiſts is, that theſe lacerations inſtead of hurting the vegetable ſerve only to increaſe its ſtrength by concentrating it more. Plants the texture of which is flaccid, and thoſe in particular immerſed in water, receive juices in abundance; but they cannot aſſimilate them, becauſe the organs are not ſufficiently vigorous in proportion to the volume of theſe plants, which have more ſize than real ſtrength. But if by internal rupture the organs which have become uſeleſs are deſtroyed and the uſeful organs are retained; in a word, if one part of the organization is ſacrificed to the other, the part which maintains itſelf receiving the whole nutritive ſubſtance will acquire more ſtrength, and the vegetable may ſtill grow with new vigour; for its ſtrength will not be diminiſhed, and its impediments will be leſs.

No lacunæ are obſerved in the embryo, becauſe its lacerations are a real diſorganization, which cannot take place in beings that begin to live. They are formed therefore only in the courſe of time. They ſhow themſelves in the petioles of fern, in the ſtems of the potamogetons, and in a multitude of other vegetables like longitudinal tubes interſperſed throughout the cellular tiſſue. In the equiſeta they affect a diſpoſition exceedingly regular; one greater than the reſt forms a tube in the centre of the ſtem; around this tube there are other very ſmall lacunæ arranged circularly, and ſome larger and cloſer to the circumference are diſpoſed in alternate order with them. The lacunæ of the leaves of the monocotyledons are interſected by frequent partitions, which are only the cellular tiſſue collected at certain diſtances, and which cloſes the tubes by membranous diaphragms. This organization, or rather diſorganization, appears through the tranſparent tiſſue of the *typha*, and a multitude of other monocotyledons with ſword-formed leaves. The ſame phænomenon may be obſerved in the tiſſue of the ſheaths of which the ſtem of the banana-tree is compoſed.

The *reſtio* has longitudinal lacunæ, and alſo tranſverſal apertures in the thickneſs of the bark: it does not appear that the latter kind of lacuna occurs often in vegetables.

One might ſuſpect that the large tubes of plants always begin by being lacunæ, and that the internal vacuities, where a new tiſſue, which increaſes both the volume and denſity of the vegetable, is developed, are only lacunæ alſo.

CHAP.

CHAP. VI.

Of the Glands.

Whether plants have glands analogous to thoſe of animals; that is to ſay, organs proper for giving to the fluids the qualities neceſſary for the development and preſervation of the being by making them undergo new combinations, and by ſeparating from them the uſeleſs or prejudicial qualities, is a queſtion not eaſy to be determined. In ſo delicate a ſubject, facts and reaſoning are equally obſcure: however, it appears to me beyond a doubt that we do not catch with our beſt microſcopes but the coarſe part of the vegetable organization. I cannot conceive that the transfuſion of the fluids of one cell into another is ſufficient to modify theſe fluids ſo far as to change them into organized matter, and to render them ſuſceptible of giving a new increaſe and new vigour to the plant. I cannot conceive either that the common laws of chemiſtry could alone effect this phænomenon, becauſe, in either hypotheſis, nothing could prevent labour or chance from unveiling to man the ſecret of nature: but this conſequence is repugnant to reaſon. It appears, then, to me more judicious to admit ſecretory organs in which the fluids are aſſimilated. It muſt, indeed, be ſuppoſed that the membranes are not impenetrable to the fluids, ſince they dilate, unfold themſelves, and change their nature; but they muſt neceſſarily modify the fluids, ſince the latter, by penetrating them, become capable of increaſing the membranous tiſſue in all its dimenſions: it is in the membranes, then, that we muſt ſearch for the vegetable glands. It might be ſuppoſed, with ſome appearance of truth, that the opake and irregular rolls with which the pores and apertures of the large tubes are bordered are glandulous bodies. The filaments of the tracheæ, the thickneſs of which greatly ſurpaſſes that of the membranes, ſeem alſo to diſcharge the ſame functions; and what gives to theſe probabilities more weight is, the conſideration that the mucilage, which is transformed into organized tiſſue, is always accumulated around the ſmall and large tubes, which are all covered with theſe opake bodies.

[To be continued.]

XXX. *Short Account of the Ornithorynchus Paradoxus, or Duck-billed Platypus.*

THIS animal, of all the quadrupeds yet diſcovered, ſeems to be the moſt extraordinary in its conformation, as it exhi-